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CURRENT INDUSTRIAL REPORTS

Selected Instruments and Related Products

1989

U.S. Department of Commerce
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SUMMARY OF FINDINGS

During 1989, the total value of shipments of selected instruments and related products totaled $61,185.4 million, up nearly 1 percent from the 1988 value of $60,728.8 million. The 1989 figure includes automatic regulating and control valves, $1,363.2 million, an increase of 8 percent over 1988; aeronautical, nautical, and navigational instruments, $2,532.3 million, an increase of 7 percent over 1988; search and detection, navigation and guidance systems and equipment, $30,522.3 million, a decrease of 2 percent from 1988; controls for monitoring residential and commerical environments and appliance regulating controls, $2,230.1 million, an increase of 1 percent from 1988; process control instrumentation, $4,803.0 million, an increase of 10 percent from 1988; test equipment for testing electrical, radio, and communication circuits and motors, $6,163.1 million, a decrease of 1 percent from 1988, and analytical and scientific instruments, valued at $3,758.7 million, an increase of 9 percent from 1988.

A description of the survey methodology and related information appears on page 19.

Table 1. VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS, BY CLASS OF PRODUCT: 1980 TO 1989

(Millions of dollars)

Product code	Product description	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980
34918	Automatic regulating and control valves	1,363.2	1,261.9	1,221.0	1,302.3	1,324.3	1,190.4	1,146.5	1,184.5	1,147.0	1,081.7
34919	Solenoid-operated valves (except nuclear and fluid power transfer)	349.2	338.3	326.9	284.8	280.1	266.6	202.6	201.5	182.7	178.3
38121	Aeronautical, nautical, and navigational instruments	2,532.3	2,365.2	2,269.7	1,788.9	1,592.0	1,466.9	1,428.6	1,404.7	1,326.6	1,069.3
38122	Search and detection, navigation and guidance systems and equipment[1]	30,522.3	31,144.9	30,910.9	29,503.7	27,056.8	22,822.6	19,981.6	17,733.4	15,040.2	12,138.9
38210	Laboratory apparatus and laboratory furniture[2]	1,694.9	1,564.9	1,549.1	1,329.9	1,138.1	1,101.1	976.2	1,028.1	899.6	840.9
38220	Controls for monitoring residential and commercial environments and appliance regulating controls	2,230.1	2,207.2	2,092.7	1,965.9	1,925.6	1,943.3	1,678.8	1,639.4	1,472.9	1,417.0
38230	Process control instruments	4,803.0	4,347.9	4,083.6	3,896.5	3,963.2	3,803.4	3,289.9	3,750.8	3,423.2	3,030.3
38242	Integrating and totalizing meters for gas and liquids	641.5	609.6	589.3	525.8	548.6	493.4	449.4	493.5	565.1	600.1
38243	Counting devices	206.3	192.5	197.8	177.4	174.9	209.4	172.9	166.7	193.2	192.1
38244	Motor vehicle instruments	639.6	681.6	232.1	197.3	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
38251	Integrating instruments, electrical	383.8	387.6	400.5	402.9	402.6	418.4	358.0	339.0	303.7	297.4
38252	Test equipment for testing electrical, radio and communication circuits, and motors	6,163.1	6,248.0	6,143.6	5,592.1	5,698.9	5,919.3	4,878.7	4,384.4	3,854.6	3,295.5
38253	Instruments to measure electricity	628.1	663.2	646.5	617.3	603.0	642.5	540.8	539.0	567.7	514.4
38260	Analytical and scientific instruments (except optical)	3,758.7	3,442.2	3,046.1	2,531.6	2,716.0	2,748.7	2,438.6	1,990.3	1,760.0	1,518.2
38271	Sighting, tracking, and fire-control equipment, optical type	564.0	609.4	726.1	651.2	556.3	562.0	479.2	492.2	324.4	310.4
38272	Binoculars and astronomical instruments[3]	92.9	63.2	35.1	24.7	1,345.8	1,442.9	1,059.9	893.7	871.9	797.0
38273	Other optical instruments and lenses (except sighting, tracking, and fire control)[3]	1,176.3	1,206.6	1,179.7	1,220.5						
38291	Aircraft engine instruments (except flight)	509.5	504.5	520.0	505.4	393.1	337.5	335.2	290.3	275.1	258.9
38292	Physical properties and kinematic testing equipment	941.0	893.9	859.4	775.1	660.8	651.9	564.4	590.7	509.4	477.9
38294	Nuclear radiation detection and monitoring instruments	674.4	654.3	637.2	587.2	542.2	494.9	503.4	561.5	453.2	388.9
38295	Commercial, geophysical, meteorological, and general purpose instruments[4]	1,041.0	1,072.4	358.0	316.5	354.4	380.5	293.9	325.4	228.4	238.9
38296	Surveying and drafting instruments[2]	270.2	269.5	246.5	229.9	379.5	326.5	246.2	256.2	270.3	279.5

(NA) Not available.

[1]Prior to 1989, data for product class 38122 "Search and detection, navigation and guidance systems and equipment," were published in the Current Industrial Report MA36P, Communication Equipment, Including Telephone, Telegraph, and Other Electronic Systems and Equipment.

[2]Starting in 1987, product class 38210 (formerly 38112) includes laboratory furniture. Prior to 1987, laboratory furniture had been included in product class 38296 (formerly 38113).

[3]Prior to 1987, "Binoculars and astronomical instruments" and "Other optical instruments and lenses" were combined under product class 38325. In 1987, these were separated into two separate product classes: 38272 and 38273.

[4]Beginning in 1988, product class 38295 "Commercial, geophysical, meteorological, and general purpose instruments" includes additional product data (product codes 38295 51 and 39295 59) formerly collected on the Current Industrial Report MA36P, Communication Equipment, Including Telephone, Telegraph, and Other Electronic Systems and Equipment.

Address inquiries concerning these figures to U.S. Department of Commerce, Bureau of the Census, Industry Division, Washington, D.C. 20233, or call Deborah Dillon, (301) 763-5194.

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Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1989 AND 1988

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1989		1988	
			Quantity	Value	Quantity	Value
34918	Automatic valves (regulating and control type, except nuclear)	134	(X)	1,363,169	(X)	1,261,906
	Engineered specification valves, designed to perform a precise degree of continuous modulation of controlled variables as the final element of a sophisticated instrumentation loop. (Commonly referred to as control valves and including certain globe, butterfly, ball, diaphragm, and similar body types, but excluding on-off valves):					
	Pneumatic actuated	(NA)	(X)	439,399	(X)	404,345
	Sliding stem valves	(NA)	829,557	222,577	820,860	203,475
34918 01	Globe body	24	784,988	174,342	781,380	r166,611
34918 02	All other types	18	44,569	48,235	39,480	r36,864
	Rotary valves	(NA)	260,094	70,847	229,762	60,574
34918 03	Ball	10	228,987	27,869	r199,671	r23,246
34918 04	Butterfly	12	31,107	42,978	r20,325	r28,271
34918 06	Plug	-			-	-
34918 07	All other rotary valves (including eccentric disk)	7			c9,766	a9,057
34918 08	All other pneumatic power-operated control valves	21	785,571	56,109	654,759	51,552
34918 09	Parts for pneumatic actuated valves (sold separately)	32	(X)	89,866	(X)	88,744
	All other actuation, including electric-actuated and electro-hydraulic actuated	(NA)	(X)	202,978	(X)	201,337
	Sliding stem valves	(NA)	49,941	21,789	56,717	20,149
34918 11	Globe body	9	3,339	9,138	3,053	7,165
34918 12	All other types	12	46,602	12,651	53,664	12,984
	Rotary valves	(NA)	39,052	12,982	r23,665	11,271
34918 13	Ball	3	1,367	3,827		
34918 14	Butterfly	5				
34918 16	Plug	4	37,685	9,155	23,665	11,271
34918 17	All other rotary valves (including eccentric disk)	3				
34918 18	All other power-operated (except pneumatic) control valves	25	4,590,400	152,145	r4,692,312	r149,771
34918 21	Parts for all other power-operated (except pneumatic) control valves	14	(X)	16,062	(X)	20,146
34918 23	Valve actuators (sold separately)	19	131,598	84,172	137,120	63,377
	Regulator valves (equipped with a self-generating power actuator acting in response and in proportion to a change in value of the controlled variable, such as temperature, pressure, flow level, etc.):					
34918 25	Remote-sensing direct actuated temperature regulators	21	1,344,370	53,687	1,585,695	59,898
34918 30	Self-contained direct actuated pressure regulators (except instrument type and safety relief valves)	34	5,298,687	164,592	4,865,013	154,528
34918 35	Pilot (internal and external) actuated pressure regulators	31	196,740	54,454	r195,470	r53,464
34918 41	Self-contained direct acting precision and instrument type pneumatic (air and gas) pressure regulators	10	379,959	23,932	333,746	21,522
34918 45	Flow regulators for gas, vapors, or liquids	38	6,162,679	143,764	4,861,043	r124,395
34918 48	Other regulator valves	36	3,291,120	141,604	r3,410,184	r128,990
34918 49	Parts for regulator valves (sold separately)	37	(X)	54,587	(X)	50,050
34919	Solenoid-operated valves (except nuclear and fluid power transfer)	44	(X)	349,228	(X)	338,254
	Solenoid-operated valves of the type actuated by the movement of a plunger or armature due to the magnetic field created by electrically energizing a solenoid coil (excluding torque motor rotary type actuated valves and servo-valves):					
	Solenoid-operated valves, except nuclear and fluid power transfer valves:					
	Commercial/Industrial types:					
34919 56	Two-way	28	4,165,984	155,806	4,203,379	149,431
34919 58	Three-way	16	643,936	22,712	r630,586	a20,320
34919 59	Other	16	20,039,671	139,526	23,568,151	140,689
34919 61	Household appliance type	2				
34919 79	Parts, components, and operators for solenoid-operated valves, except nuclear and fluid power transfer valves (sold separately)	16	(X)	31,184	(X)	27,814
38121	Aeronautical, nautical, and navigational instruments, except aircraft engine instruments	103	(X)	2,532,275	(X)	2,365,152
	Flight and navigation sensors, transmitters, and displays:					
38121 01	Compasses (magnetic and gyroscopic)	20	(X)	314,581	(X)	152,553
38121 08	Altimeters (except radio and radar altimeters)	14	(X)	55,421	(X)	r36,145
38121 10	Airspeed indicators (including machmeters and air data computers)	17	(X)	340,082	(X)	309,413
38121 12	Acceleration indicators and systems components	9	(D)	(D)	(D)	(D)
38121 13	Rate-of-climb indicators	11	10,821	10,486	13,131	11,676
38121 15	Angle-of-attack indicators	7	2,299	8,466	2,727	9,495
38121 17	Bank and turn indicators	4	(D)	(D)	(D)	(D)
38121 18	Artificial horizon flight instruments	8	13,741	34,023	19,678	48,145
38121 20	Other aerospace and navigational instruments	29	(X)	381,421	(X)	r449,005

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1989 AND 1988--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1989		1988	
			Quantity	Value	Quantity	Value
	Aeronautical, nautical, and navigational instruments, except aircraft engine instruments--Continued					
	Gyroscopes sold separately:					
38121 21	Vertical	8	7,383	22,912	8,037	24,469
38121 23	Directional	7	9,407	30,764	r11,492	r45,040
38121 25	Free, torqued and untorqued	3	(X)	33,463	(X)	62,322
38121 26	Rate, inertial grade	4	(X)	41,622		
38121 28	Rate, noninertial grade	6	(X)	152,459	(X)	147,030
	Airframe equipment instruments:					
38121 61	Position indicators (mechanical, as for landing gear, cowl flaps, stabilizers, etc.)	13	(X)	28,281	(X)	r35,275
38121 63	Hydraulic system (both electrical and mechanical measuring means, as for liquid level and temperature and pressure indicators)	12	(X)	50,389	(X)	r46,646
38121 64	Cabin environmental measuring and control instruments (air-conditioning and heating, cabin pressure, oxygen, etc.)	15	(X)	78,789	(X)	r60,816
38121 77	Thermocouple and thermocouple lead wire (aircraft type only)	3	(X)	(D)	(X)	(D)
38121 80	Other aerospace flight instruments	27	(X)	444,544	(X)	442,266
38121 85	Nautical instruments (all types, including temperature, speed, pitch, and roll instruments and system components, etc.)	17	676,681	104,282	r625,951	r98,340
38121 89	Parts and components for aeronautical, nautical, and navigational instruments, except aircraft engine instruments, (sold separately)	21	(X)	159,328	(X)	r181,122
38122 --	Search and detection systems and navigation and guidance systems and equipment[1]	234	(X)	30,522,337	(X)	31,144,933
38122 11	Light reconnaissance and surveillance electronic systems and equipment (infrared, ultraviolet, and visible light), including bomber-defense equipment, fire control equipment (except optical), IR fuses, space satellite and other IR detection and warning systems, snooperscopes, snoopascopes, night driving equipment, mapping equipment, photographic equipment, wake detection; and electronic checkout, monitoring, evaluation and other electronic support equipment for light reconnaissance and surveillance electronic systems	44	(X)	2,608,325	(X)	2,865,923
38122 13	IFF equipment	14	(X)	289,094	(X)	287,710
38122 15	Proximity fuses	9	(X)	359,903	(X)	300,564
	Radar systems and equipment:					
	Search, detection, and acquisition radar systems and equipment (BMEWS, airborne and other early warning radar, air traffic control radar, air defense and fighter control radar, ship radar, harbor control radar, meteorological radar, etc.):					
38122 17	Airborne and missile/space radar	25	(X)	1,276,323	(X)	r1,358,015
38122 19	Ship (marine) radar	18	(X)	1,491,072	(X)	r1,235,370
38122 21	Ground radar	34	(X)	878,595	(X)	1,065,421
	Tracking radar systems and equipment (fire control, bombing, bombing navigational radar, aircraft and missile tracking radar, etc.):					
38122 23	Airborne and missile/space radar	18	(X)	1,721,042	(X)	1,591,218
38122 25	Ship (marine) radar	14	(X)	375,073	(X)	r367,360
38122 27	Ground radar	19	(X)	1,150,968	(X)	r956,973
	Instrumentation radar systems and equipment (altimeters, highway speed control radar, missile and space satellite tracking range radar, GCA and other precision approach radar, etc.):					
38122 29	Airborne, missile/space and ship (marine) radar	10	(X)	137,009	(X)	160,942
38122 31	Ground radar	5	(X)	10,048	(X)	60,486
38122 33	Electronic checkout, monitoring, evaluation, and other electronic support equipment for radar systems	18	(X)	330,981	(X)	453,591
	Sonar search, detection, tracking and communication systems and equipment including ASW (sonar telephone communication equipment, depth finding, fire control, fuzing, guidance, hydrophones, mapping, sonabuoys, navigation, sonar fish finders, sonar range instrumentation, and other):					
38122 35	Surface ship applications (destroyers, destroyer escort, etc.)	20	(X)	456,129	(X)	402,799
38122 37	Submarine applications	33	(X)	840,035	(X)	906,860
38122 39	Airborne	19	(X)	404,440	(X)	r425,914
38122 41	Electronic checkout, monitoring, evaluation, and other electronic support equipment for sonar systems and submerged fixed systems	12	(X)	199,641	(X)	251,691
38122 43	Specialized command and control data processing and display equipment, sold separately from complete systems	28	(X)	1,247,961	(X)	1,519,043

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1989 AND 1988--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1989		1988	
			Quantity	Value	Quantity	Value
	Search and detection systems and navigation and guidance systems and equipment--Continued					
38122 45	Search, detection, identification, and tracking systems and equipment n.e.c.	35	(X)	1,810,281	(X)	1,783,965
	Electronic warfare systems and equipment:					
	Countermeasures equipment:					
38122 47	Jamming equipment, communications, and radar	39	(X)	2,160,763	(X)	2,564,020
38122 49	Underwater countermeasures equipment	5	(X)	652,824	(X)	750,663
38122 51	Other active countermeasures equipment (excluding passive materials such as chaff, window, needles, rope, etc.)	16				
38122 53	Specialized electronic and communication intelligence equipment, including specially designed DF equipment, signal reduction and processing equipment, and signal analyzers and display equipment	39	(X)	2,208,812	(X)	2,271,658
	Missile and space vehicle systems and equipment (beam riders, command guidance, inertial systems, infrared homing systems, radar systems, stellar trackers, television systems, combination systems, etc.):					
38122 55	Missile-borne and space-vehicle-borne equipment	43	(X)	4,311,886	(X)	4,452,075
38122 57	Nonmissile and space vehicle guidance equipment (ground, ship, or airborne command guidance systems, etc.)	10	(X)	485,292	(X)	482,747
38122 59	Electronic checkout, launching, and other missile and space vehicle support systems (ground, ship, and air)	24	(X)	481,673	(X)	629,419
	Navigation systems and equipment, navigational aids for aircraft, ship, and ground navigation (autopilots, beacons, transponders, collision warning devices, DECCA, DME, ILS, Doppler navigation systems, inertial navigation systems, optical/laser LORAN, radio compasses and direction finders, SHORAN, TACAN, VOR, VORTAC equipment, etc.):					
	Airborne navigational systems:					
38122 61	Radio navigation receivers and displays (including OMNI, radio magnetic, glide slope/localizer, DME, etc.)[2]	23	(X)	460,086	(X)	r402,077
38122 63	Airborne integrated data systems/flight recorders	10	(X)	284,743	(X)	r246,238
38122 65	Distance measuring equipment (DME)	11	(X)	81,289	(X)	r63,168
38122 67	Flight directors/situation display	8	(X)	513,150	(X)	r253,034
38122 69	Heads-up display (HUD) systems	6			(X)	173,579
38122 71	Inertial navigation systems	5	(X)	596,378	(X)	539,975
38122 73	Proximity warning/collision avoidance equipment	3			(X)	301,727
38122 75	Complete automatic pilots	6	(X)	314,753	(X)	533,982
38122 77	Other airborne navigational systems	25	(X)	609,193		
38122 78	Directional finder kits to be assembled by purchaser	35	(X)	684,007	(X)	r612,607
38122 79	Surface (ship and ground) navigational systems	10				
38122 81	Underwater navigational systems					
38122 83	Electronic checkout, monitoring, evaluation, and other electronic support equipment for navigational systems and equipment	45	(X)	1,090,568	(X)	r874,119
38210	Laboratory apparatus and laboratory furniture	185	(X)	1,694,886	(X)	1,564,909
	Laboratory balances and scales:					
38210 11	Sensitivity of 5 centigrams or better	11	828,693	43,390	1,391,211	55,792
38210 13	Sensitivity of less than 5 centigrams	9				
38210 15	Laboratory furnaces and ovens	25	(X)	39,334	(X)	r37,369
	Laboratory centrifuges:					
38210 17	Table-top type	14	23,217	30,924	25,512	33,257
	Floor type:					
38210 18	Refrigerated	4	6,905	36,264	6,593	32,835
38210 20	Other	3	(D)	(D)	(D)	(D)
38210 27	Laboratory evaporation and distillation apparatus	14	(X)	16,715	(X)	r16,260
38210 28	Laboratory sterilizers and autoclaves	14	(X)	33,560	(X)	r37,060
38210 29	Laboratory burners and hot plates	11	(X)	9,203	(X)	8,912
38210 31	Laboratory granulators, mills, and other particle size reduction apparatus	10	(X)	3,400	(X)	r2,985
38210 33	Laboratory dryers	9	(X)	7,663	(X)	5,781
38210 35	Laboratory blenders, mixers, shakers, dispensers, fraction collectors, and other liquid sample preparation apparatus	31	(X)	72,628	(X)	65,432
38210 36	Laboratory incubators	15	14,114	44,046	14,535	42,551
38210 38	Laboratory freezers	12	9,506	31,296	9,221	27,562
38210 42	Microtomes	3	(X)	(3)	r1,348	6,625
38210 81	Laboratory furniture, including cabinets, cases, benches, tables, stools, reagent shelves, etc	22	(X)	300,342	(X)	286,558
38210 88	Parts and components for laboratory furniture (sold separately)	4	(X)	(D)	(X)	(D)
38210 98	All other laboratory and scientific apparatus not specified above (including wet and dry baths, melting point apparatus, etc., excluding analytical instruments)	99	(X)	3621,982	(X)	612,847
38210 99	Components, parts and accessories for laboratory and scientific apparatus (sold separately)	56	(X)	332,420	(X)	r220,396

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1989 AND 1988--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1989		1988	
			Quantity	Value	Quantity	Value
38220	Controls for monitoring residential and commercial environments and appliance regulating controls	95	(X)	2,230,089	(X)	2,207,177
	Automatic controls of the type principally used as components of air conditioning, refrigeration, and comfort heating (including pneumatic controls):					
	Temperature responsive (thermostats):					
38220 21	Electric	37	41,265,878	416,132	44,152,569	393,311
38220 22	Pneumatic	9	11,925,971	85,788	12,391,403	r89,663
38220 25	Pressure responsive (pressurstats)	12	7,521,163	56,847	9,144,452	70,567
38220 30	Hydronic responsive	6	3,842,949	51,169	3,713,954	46,305
38220 35	Humidity responsive (humidistats)	4				
38220 40	Light responsive	1				
38220 45	Electrostatic responsive	1	1,490,563	a13,264	1,391,570	a10,713
38220 50	Liquid level	4				
38220 55	Defrost controls (except appliance regulators)	2				
	Automatic controls of the type principally used as components of air conditioning, refrigeration, and comfort heating (including pneumatic controls):--Cont.					
38220 60	Igniters	7	115,188,574	177,989	r106,477,157	163,481
38220 65	Inherent motor protectors	5				
38220 66	Microprocessor-based load programmers for buildings energy control	9	106,226	66,928	96,231	49,243
	Computerized energy control systems for buildings:					
38220 67	Under 100 points (systems)	2				
38220 68	100 to 199 points (systems)	3	73,614	415,735	64,900	409,316
38220 69	200 or more points	5				
38220 71	Upgrades or additions to existing computerized energy control systems for buildings (value only)	1	(X)	272,236	(X)	285,775
38220 74	Other	20				
	Controls for major appliances such as domestic laundry and cooking appliances, refrigerators and freezers, vending machines, air conditioners, etc.:					
38220 75	Temperature responsive	20	128,716,493	252,662	124,998,416	248,206
38220 77	Hydraulic and pneumatic	1				
38220 78	Pressure responsive	2	74,350,493	273,417	77,345,507	r276,481
38220 81	All other controls for appliances	13				
38220 98	Parts and components for controls monitoring residential and commercial environments and for appliance regulating controls (sold separately)	20	(X)	147,922	(X)	r184,116
38230	Process control instruments	410	(X)	4,802,982	(X)	4,347,883
	General purpose control system instruments (commonly called receiver-type), operating from standardized transmission signals (electrical types a.c. or d.c. milliampere, millivolt, or telemetering signals; pneumatic types, 3 to 15 and 3 to 27 p.s.i. signals):					
	Electronic systems - unified architecture type:					
38230 35	Controllers (recording, indicating, or blind)	39	272,375	151,690	268,555	126,635
38230 36	Recorders, with or without self-contained set-point stations	27	45,834	75,991	r49,206	r74,426
38230 37	Indicators, with or without self-contained set-point stations	28	107,785	43,224	r106,124	41,572
38230 38	Auxiliary stations and analog computing devices associated with the above (including manual loaders, auto-to-manual stations, ratio stations, adders, multipliers, integrators, etc.)	15	23,529	14,767	17,291	10,514
38230 07	Electronic systems - non-unified architecture type	53	(X)	1,015,893	(X)	860,252
38230 12	Industrial multi-function process computers	46	(X)	183,456	(X)	177,853
	Pneumatic systems (including all system-type control, display and computing instruments actuated from standardized pneumatic transmission signals):					
38230 39	Controllers (recording, indicating, or blind)	16	66,066	48,171	80,447	47,682
38230 40	Recorders, with or without self-contained set-point stations	7	4,444	7,229	3,582	5,929
38230 41	Indicators, with or without self-contained set-point stations	7	6,638	1,734	r2,913	r495
38230 42	Auxiliary stations and analog computing devices associated with the above (including manual loaders, auto-to-manual stations, ratio stations, adders, multipliers, integrators, etc.)	5	56,207	20,515	45,518	15,702
38230 43	Receiver-type gauges, analog and digital	13	294,372	9,629	r342,366	r10,306
38230 44	Annunciators, industrial; electromechanical and solid-state types	8	12,852	26,233	r12,654	25,791
	Temperature measuring instruments (excluding general purpose receiver-type instruments):					
	Electrical and electronic measuring types (thermocouple, resistance temperature detector, radiation, optical, thermistor, and other electrical sensors):					
38230 45	Direct-deflecting types (controllers for all types of electrical temperature sensors)	9	9,583	5,039	r7,944	r3,973
38230 46	Direct-deflecting types (indicators and recorders for all types of electrical temperature sensors)	14	155,654	9,930	138,501	8,527
38230 47	Electromechanical self-balancing types (electric or pneumatic controllers for all types of electrical temperature sensors)	5				
38230 48	Electromechanical self-balancing types (indicators, recorders, and integrators for all types of electrical temperature sensors)	6	118,231	33,808	123,546	33,932
38230 49	Electronic controllers for all types of electrical temperature sensors	31	380,155	a88,727	384,325	79,960

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1989 AND 1988--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1989		1988	
			Quantity	Value	Quantity	Value
	Temperature measuring instruments (excluding general purpose receiver-type instruments):--Continued					
	Electrical and electronic measuring types (thermocouple, resistance temperature detector, radiation, optical, thermistor, and other electrical sensors):--Continued					
38230 50	Digital indicators for all types of electrical temperature sensors (excluding data loggers)	31	67,183	28,303	91,129	59,756
	Transmitters, producing standardized electric or pneumatic analog transmission signals for all types of electrical temperature sensors:					
38230 54	Electric	15	96,887	23,531	r82,113	r20,666
38230 55	Pneumatic	6	2,919	1,573	r3,408	r1,985
	Mechanical measuring types, filled systems (liquid filled, vapor pressure, gas filled, and mercury filled types):					
38230 52	Indicating or recording controllers	14	321,569	28,034	r238,880	r20,276
38230 53	Recorders, noncontrol	18	22,365	11,177	r26,864	r11,257
38230 56	Indicators only (excluding indoor-outdoor and other household or appliance type thermometers)	19	934,770	25,319	r1,142,069	29,563
38230 57	Transmitters producing standardized electric or pneumatic analog transmission signals	9	33,240	13,407	30,378	12,761
	Primary temperature sensors (excluding aircraft types):					
38230 59	Thermocouples and thermocouple lead wire	55	(X)	228,389	(X)	184,471
38230 60	All other types (resistance temperature detectors, radiation and optical sensors, thermistors, etc.)	40	(X)	72,928	(X)	a69,310
	Pressure (gauge, absolute vacuum) and draft measuring instruments (excluding general purpose receiver-type instruments):					
38230 61	Indicating or recording controllers	23	a245,932	a41,075	265,276	37,788
38230 62	Recorders, noncontrol	12	3,959	2,898	3,818	2,541
	Indicators only (excluding receiver-type gauges):					
38230 20	3-inch diameter and over	21	3,081,463	94,266	3,210,140	94,048
38230 21	Under 3-inch diameter	14	20,350,273	59,116	22,081,996	61,481
	Transmitters producing standardized analog transmission signals:					
38230 24	Transmitters producing standardized electronic analog transmission signals	28	3,065,472	177,134	3,155,820	157,945
38230 25	Transmitters producing standardized pneumatic analog transmission signals	11	10,051	7,060	r10,491	r6,091
	Flow and liquid level measuring instruments (excluding general purpose receiver-type instruments):					
	Differential pressure types:					
38230 65	Indicating or recording controllers	15	57,703	14,833	48,874	10,107
38230 66	Recorders, noncontrol; and indicators, noncontrol	18	80,390	39,608	r82,483	36,048
	Transmitters producing standardized analog transmission signals:					
38230 27	Transmitters producing standardized electronic analog transmission signals	21	294,342	147,987	288,929	137,101
38230 28	Transmitters producing standardized pneumatic analog transmission signals	8	25,920	17,863	27,503	16,624
38230 29	Primary pressure sensors (load cells, strain gauges, etc.)	9	98,900	51,936	99,039	56,528
38230 68	Primary flow elements (including orifice plates, venturi tubes, flow tubes, flow nozzles, pitot tubes, etc.)	21	371,894	38,067	r343,025	37,192
	Electromagnetic flowmeters:					
38230 03	Primary device (magnetic flow tube)	10	150,956	64,997	134,796	52,818
38230 01	Secondary device (magnetic transmitter, recorder, indicator or controller which receives signal directly from primary device)	14	a35,733	a28,312	a34,260	a24,384
38230 04	Capacitance, ultrasonic, and other electronic types (including magnetic resonance, vortex-precession, and vortex-shedding type elements)	27	147,687	99,654	r134,699	84,073
38230 71	Variable area-controlling, recording, indicating, and transmitting instruments and associated primary flow elements	16	934,651	73,614	r810,962	r67,310
38230 72	Float and displacement (controlling, recording, indicating, and transmitting instruments and associated primary flow elements.)	19	1,547,513	64,915	1,526,318	56,133
38230 73	Turbine, mass-flow and other types (controlling, recording, indicating, and transmitting instruments and associated primary flow elements)	27	123,607	132,295	126,281	116,147
38230 74	Humidity instruments (controlling, recording, indicating, and transmitting, and associated primary humidity elements; excluding home and general purpose type)	17	49,367	29,238	48,767	r29,031

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1989 AND 1988--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1989		1988	
			Quantity	Value	Quantity	Value
	Process control instruments--Continued					
	Continuous process instruments for on-stream gas and liquid analysis (including indicators, recorders, controllers, and analysis electrodes and cells; excluding laboratory analysis types):					
38230 75	Chromatographic analyzers	9	3,379	70,703	2,540	50,559
38230 76	Infrared analyzers	17	11,671	37,457	8,199	29,630
38230 77	Oxygen analyzers	17	18,448	35,005	17,696	33,364
38230 78	Other gas analyzers	32	51,730	82,527	52,503	81,454
38230 79	Ph analyzers	13	72,302	30,452	57,939	25,101
38230 80	Other liquid analyzers	21	56,399	68,493	r61,298	56,025
	Instruments for all process variables not listed above (speed, weight, position, sequence, density, specific gravity, mechanical load, electrical load, millivolts):					
	Electrical and electronic measuring types:					
38230 06	Direct-deflecting type controllers, indicators and recorders	6	13,523	8,471	11,761	7,036
38230 08	Electromechanical self-balancing electric or pneumatic controllers, indicators, recorders, integrators	6	34,714	10,594	38,637	16,656
38230 85	Digital indicators	11	7,779	16,271	7,752	16,027
38230 86	Transmitters producing standardized electric or pneumatic analog transmission signals	10	4,286	9,382	r4,816	r6,995
	Mechanical measuring types:					
38230 87	Indicating or recording controllers	5	30,141	8,310	r40,367	8,788
38230 88	Recorders, noncontrol	3				
38230 89	Indicators only	3	86,093	9,310	70,764	8,379
38230 90	Transmitters producing standardized electric or pneumatic analog transmission signals	13	195,373	52,027	234,358	r51,975
	All other industrial process instruments:					
38230 91	Other temperature instruments	30	(X)	194,336	(X)	181,346
38230 92	Other flow and liquid level instruments	22	(X)	53,319	(X)	r56,200
38230 93	Other continuous process instruments	25	(X)	141,110	(X)	r126,065
38230 94	Other industrial type instruments	57	(X)	319,412	(X)	317,146
	Parts, supplies, accessories, other primary sensors n.e.c., panelboards, and other equipment associated with process control instrumentation:					
38230 95	Primarily designed for temperature instruments	9	(X)	17,086	(X)	14,832
38230 96	Primarily designed for flow and liquid level instruments	27	(X)	53,556	(X)	r37,449
38230 97	Primarily designed for continuous process instruments	26	(X)	144,664	(X)	138,896
38230 99	Primarily designed for industrial type instruments	32	(X)	a86,932	(X)	a r66,976
38242	Integrating and totalizing meters for gas and liquids	36	(X)	641,519	(X)	609,646
	Gas meters, consumption registering:					
	Diaphragm type: Positive displacements; aluminum, iron, and tin case:					
38242 22	Residential size (up to 400 cu. ft./hr. of 0.64 specific gravity gas, at 0.5 inches water drop)	4	2,192,054	102,462	2,153,352	98,668
38242 24	Other sizes, including commercial and industrial	5	92,789	36,340	88,975	32,351
38242 26	Rotary type (all sizes)	3			32,743	43,872
38242 28	Turbine type (all sizes)	6	35,089	48,182	-	-
38242 29	Other gas meters, consumption registering	1				
	Liquid meters, positive displacement with registers and counters:					
	Water meters, consumption registering:					
38242 33	Small meters, up to and including 1 inch	10	4,110,340	133,587	3,853,979	122,482
38242 35	Intermediate meters, over 1 inch up to and including 2 inch	14	156,688	31,108	r154,326	30,771
38242 37	Large meters, over 2 inch	10	45,256	44,125	48,734	46,277
38242 41	Liquid fuel dispensing meters (excluding service station dispensing pumps)	7	543,523	147,707	469,353	128,663
38242 98	Other liquid meters; industrial bulk plants, pipeline, batching, treatment facilities	12				
38242 99	Parts, components, and accessories for gas and liquid meters (sold separately)	26	(X)	98,008	(X)	106,562
38243	Counting devices (excluding motor vehicle instruments)	43	(X)	206,347	(X)	192,525
38243 19	Tachometers, including speed indicators	3	2,819,790	25,978	r80,470	2,303
	Other:					
38243 21	Mechanical input	11			2,789,320	23,755
38243 23	Electrical input	13	a2,741,538	40,526	a2,698,182	38,939
38243 25	Electronic input	16	685,364	59,357	r514,242	50,666
38243 27	Pneumatic input	2				
38243 29	Other counters, including event recorders	-				
38243 76	Taximeters	4				
38243 82	Parking meters, including parts and components sold separately	2	(X)	73,976	(X)	70,792
38243 85	All other counting devices not specified above, including toll meters, fare collection equipment (systems), parking lot systems, etc., but excluding parking meters	6				
38243 88	Components and parts for counting devices, except parking meters (sold separately)	9	(X)	6,510	(X)	r6,070

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1989 AND 1988--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1989		1988	
			Quantity	Value	Quantity	Value
38244	Motor vehicle instruments	23	(X)	639,564	(X)	681,603
38244 11	Speedometers (speedometers including odometers are classified as speedometers)	9	(X)	(D)	(X)	(D)
38244 21	Tachometers	12	(X)	41,079	(X)	r43,978
38244 31	Odometers (speedometers including odometers are classified as speedometers)	6	(X)	2,430	(X)	3,019
38244 41	Fuel level gauges	6	(X)	3,418	(X)	4,431
38244 45	Water temperature gauges	6	(X)	5,347	(X)	6,932
38244 51	Ammeters	6	(X)	4,941	(X)	3,981
38244 55	Oil pressure gauges	6	(X)	3,786	(X)	4,532
38244 99	Other motor vehicle instruments	20	(X)	(D)	(X)	(D)
38251	Integrating instruments, electrical	17	(X)	383,828	(X)	387,613
	A.c. watt-hour meters:					
	Single phase:					
38251 10	Detachable types	4				
38251 11	A-base types	1	3,829,448	109,296	3,916,059	99,177
38251 14	Switchboard types	1				
38251 15	Polyphase	8	322,071	64,415	300,745	58,245
38251 35	Demand meters (kW and kVA), combined watt-hour and demand meters (single phase and polyphase), and combined watt-hour and time switch meters	7	444,744	112,509	467,372	118,556
38251 51	Other electrical integrating meters (including d.c. watt-hour meters, ampere-hour meters, and other miscellaneous integrating instruments not included in the above classifications)	6	(X)	b10,919	(X)	r29,627
38251 61	Parts and accessories for electric integrating meters (including meter mountings and registers) sold separately	10	(X)	a86,689	(X)	82,008
38252	Test equipment for testing electrical, radio and communication circuits, and motors	326	(X)	6,163,135	(X)	6,248,015
	Voltage, current, and resistance measuring equipment (except multimeters):					
	Electronic:					
38252 20	Digital	30	(X)	237,825	(X)	221,542
38252 21	Analog	25	(X)	22,585	(X)	31,539
38252 22	Electrical (excluding panel meters)	18	(X)	33,408	(X)	r31,256
	Multimeters:					
	Electronic:					
38252 28	Digital	24	(X)	a146,143	(X)	115,364
38252 29	Analog	7	(X)	18,737	(X)	16,734
38252 30	Electrical	8				
	Power and energy measuring equipment:					
	Electronic:					
38252 25	Analog	22	(X)	18,266	(X)	22,439
38252 26	Digital	22	(X)	70,338	(X)	54,960
38252 27	Electrical power measuring equipment (excluding electrical integrating instruments, sold separately)	7	(X)	1,283	(X)	1,733
	Frequency counters, timers, and other frequency and time measuring equipment (excluding standards):					
38252 31	Universal counters with time interval measuring capability	10	(X)	32,422	(X)	33,136
38252 36	Stroboscopes	2	(X)	39,672	(X)	37,026
38252 32	Microwave counters (capable of operating over 1300 MHz)	4				
38252 33	Other frequency counters	9	(X)	7,016	(X)	6,243
38252 34	Frequency meters	7	(X)	29,551	(X)	27,829
38252 39	Other frequency counting and time measuring equipment	7				
	Waveform measuring and/or analyzing equipment:					
	Oscilloscopes and plug-in accessories:					
38252 12	Under 10 MHz	7	(X)	132,561	(X)	139,494
38252 10	10 MHz up to 99.9 MHz	9				
38252 11	100 MHz and over	4	(X)	(D)	(X)	(D)
38252 14	Oscillographs	1	(X)	(D)	(X)	(D)
	Spectrum analyzers:					
38252 15	Capable of operating above 100 kHz	6	(X)	74,318	(X)	70,480
38252 17	Other spectrum analyzers	5				
38252 16	Other waveform measuring and anlyzing equipment	27	(X)	213,327	(X)	196,702
	Signal generating equipment:					
38252 56	Audio	18	(X)	10,590	(X)	r14,424
38252 58	RF (over 20 kc to 890 megacycles)	25	(X)	175,838	(X)	264,600
38252 59	Microwave (890 megacycles and above)	15	(X)	110,559		
	Field strength and intensity measuring equipment (including RFI measuring equipment):					
38252 91	Electronic	13	(X)	(D)	(X)	(D)
38252 92	Electrical field measuring equipment	2	(X)	(D)	(X)	(D)

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1989 AND 1988--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1989		1988	
			Quantity	Value	Quantity	Value
	Test equipment for testing electrical, radio and communications circuits, and motors--Continued					
	Impedance and standing wave ratio measuring equipment (transfer function measuring equipment):					
38252 93	Electronic impedance and related measuring equipment	10	(X)	24,243	(X)	25,929
38252 94	Standing wave measuring equipment (slotted lines, sliding shorts, reflectometers, and other SWR equipment)	9	(X)	19,284	(X)	r22,888
38252 97	X-Y plotters (recorders), electronic	5	(X)	7,857	(X)	15,932
	Automatic test and measuring equipment:					
38252 44	Combination and/or group test sets	37	(X)	530,120	(X)	505,989
	Component part test sets:					
38252 45	Electron tube test equipment	4	(X)	a1,294	(X)	a1,424
	Semiconductor component test equipment:					
38252 61	Memory	11	(X)	66,424	(X)	a109,642
38252 63	Linear	10	(X)	94,957	(X)	r121,697
38252 65	Microprocessor	5	(X)	54,713	(X)	r112,556
38252 67	Other semiconductor component test equipment	34	(X)	280,662	(X)	r236,678
38252 69	Circuit board loaded test equipment	22	(X)	283,145	(X)	304,070
38252 47	Other component part test sets and equipment	18	(X)	239,164	(X)	r229,381
38252 48	Equipment and subassembly test equipment n.e.c. (including disc drive testers, power supply testers, etc.)	32	(X)	372,812	(X)	390,556
	Standards and calibration equipment for test measuring equipment, including laboratory types (metered benchtop, rack mountable, or plug-in equipment):					
38252 72	Electronic	34	(X)	185,774	(X)	r195,722
38252 74	Electrical	9				
	Analyzers for testing characteristics of internal-combustion engines (excluding aircraft):					
38252 37	Portable	6	(X)	272,823	(X)	280,805
38252 38	Other	7				
	Communications test equipment n.e.c.:					
38252 81	Network analyzers	11	(X)	143,118	(X)	113,584
38252 83	Cable backplane and other continuity testers	11	(X)	a24,464	(X)	r24,708
38252 85	Fiber optics test equipment (OTDR, optical S/N meters, etc.)	5	(X)	13,331	(X)	r13,288
38252 87	Other communications test, monitoring, and control equipment (except microwave)	30	(X)	271,056	(X)	r294,817
38252 52	Microwave test equipment n.e.c., (1,300 MHz and above)	12	(X)	45,102	(X)	r54,291
	Logic test, development, and analysis equipment:					
38252 01	Logic analyzers, and similar logic state, timing, and signature analyzers	7	(X)	239,343	(X)	267,115
38252 03	Microprocessor development systems	8				
38252 05	Pulse, function, and data generators and similar metered frequency synthesizers	12	(X)	108,511	(X)	r115,950
	Other field service test and measurement equipment:					
38252 07	Logic probes, clips, comparators, pulsers, and current tracers	8	(X)	7,348	(X)	17,477
38252 09	Other field service equipment specifically designed for other troubleshooting digital circuits	2				
38252 02	Other measuring and checking instruments for testing electrical, radio and communication circuits, and motors	43	(X)	524,928	(X)	547,752
	Other analyzing instruments for checking electrical quantities:					
38252 04	With a recording device	1	(X)	114,792	(X)	r131,698
38252 06	Other	12				
38252 99	Parts and components for test equipment for testing electrical, radio and communication circuits, and motors (sold separately)	44	(X)	269,627	(X)	r262,658
38253	Instruments to measure electricity	93	(X)	628,085	(X)	663,219
	Electrical indicating instruments (including both digital types and those where a pointer is made to move over a calibrated scale, such movement being effected by the action of the electrical current and/or voltage):					
	Panel type instruments (includes all aircraft types and all miniaturized instruments + or - 3%) and rectifier instruments which can be enclosed in a case suitable for mounting on a panel and are an end product. (Excludes all instruments for use on motor vehicles which are capable of accuracies of + or - 2% of full scale indication):					
38253 08	Digital panel meters (DPM) between 0.05% and 1%, + or - 1 digit accuracy (excluding precision DVM's and electronic counters)	23	780,508	57,317	588,807	r44,546
38253 10	Analog solid state panel meters (generally of + or - 2% accuracy) with LED, LCD, or neon gas discharge display	8	83,110	5,853	80,479	5,634

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1989 AND 1988—Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1989		1988	
			Quantity	Value	Quantity	Value
	Instruments to measure electricity--Continued					
	Panel types other than ruggedized or sealed (generally of 2% accuracy):					
38253 12	A.c. (including moving iron vane and dynamometer types)	12	372,945	10,675	399,975	17,504
38253 13	D.c. (including rectifier and self-contained thermocouple types)	18	1,938,046	37,072	1,668,801	33,412
38253 11	Panel types ruggedized or sealed (generally of 2% accuracy)	13	200,964	11,847	216,611	9,367
	Electrical indicating instruments (including both digital types and those where a pointer is made to move over a calibrated scale, such movement being effected by the action of the electrical current and/or voltage):—Continued					
	Panel types with control or signal initiating means (including instrument relays):					
38253 16	Indicating	6	82,541	6,221	84,263	5,638
38253 17	Nonindicating	4			r7,507	1,547
38253 19	All other panel type instruments, including ammeters and voltmeters for motor vehicles	13	11,375,803	51,813	10,305,642	51,672
	Switchboard instruments which are generally of 1% accuracy:					
38253 23	A.c. (including moving iron vane and dynamometer types)	7	96,223	15,508	119,271	22,628
38253 25	D.c. (including rectifier and thermocouple types)	7	65,364	7,056	43,568	5,930
38253 27	Elapsed time meters (with and without reset)	9	788,859	22,133	871,957	23,375
	Portable instruments which are generally capable of accuracies within + or - 2% of full scale indication, and can be enclosed in a case so that they can be moved and used at various locations, and which are an end product:					
38253 29	Portable types (accuracy rating 0.11% through 0.50%)	6	2,930	1,917	2,040	1,660
38253 30	Portable type (accuracy rating 0.51% through 2%)	8	18,140	2,715	r20,594	r4,080
38253 35	Laboratory portable instruments with accuracies within + or - 1% up to 1/10% of full scale and better (all case sizes)	3	7,066	2,388	6,369	2,138
38253 37	Volt-ohm millimeter (VOM), accuracy 0.10% through 5%	3	457,623	39,568	r434,760	r37,582
38253 45	Other electrical indicating instruments (except self-balancing types)	12				
	Electrical recording instruments (portable and for panel mounting):					
38253 50	Direct deflecting (direct acting), except temperature calibrated instruments	5	44,260	11,390	67,652	r12,138
	Oscillographic recorders:					
38253 63	Pen or stylus type	8	99,188	66,437	108,452	72,108
38253 65	Light beam type	3				
38253 72	Other electrical recording instruments	18	(X)	191,813	(X)	r223,397
	Parts and accessories for indicating and recording instruments:					
38253 74	Transducers for volts, amperes, watts, vars, frequency, temperature and power factor	16	(X)	47,046	(X)	48,301
38253 75	Tachometer generators except aerospace types	8	(X)	17,924	(X)	17,978
38253 76	Other including instrument shunts	16	(X)	21,392	(X)	22,586
38260	Analytical and scientific instruments (except optical)	205	(X)	3,758,663	(X)	3,442,136
	Electrochemical instruments:					
38260 01	Ph electrodes and meters	21	(X)	37,937	(X)	r32,848
38260 03	Ion selective electrodes and meters	10	(X)	20,223	(X)	r21,334
38260 04	Electrophoresis instruments	13	(X)	61,917	(X)	r44,532
38260 05	Other, except process type (include photometers)	11	(X)	24,074	(X)	r19,718
	Chromatographic instruments:					
38260 07	Gas	15	100,324	202,984	99,326	202,132
38260 08	Liquid	23	51,248	328,783	57,608	r350,535
38260 09	Other, including paper, gel, thin layer	7				
	Spectrophotometric instruments:					
38260 24	Atomic absorption	4	(X)	93,774	(X)	99,815
38260 25	Optical emission, including spark, arc, and glow, spectrographs, all other, except ICP	5	(X)	a19,434	(X)	r14,620
38260 27	Optical emission, including laser excited source (including laser microprobe source emission, laser source Raman and laser microprobe source Raman spectrometers)	3	(X)	a37,276	(X)	26,681
38260 28	Optical emission with inductively coupled plasma, ICP	3				
38260 30	Infrared (including Fourier transfon methods)	17	(X)	239,786	(X)	227,086
38260 31	Ultraviolet, visible and colorimeters	22	(X)	93,192	(X)	105,161
38260 33	Fluorescent instruments, including fluorometers (except chemicals)	10	(X)	39,197	(X)	r43,450
38260 35	Color measuring devices	10	(X)	93,980	(X)	82,752
38260 36	Other, including vacuum ultraviolet, Raman, light scattering reflectors, helium glow, and light measuring	9	(X)	14,575	(X)	r15,145
38260 37	Thermal analysis instruments, including thermogravimetric analyzers (TGA), quantitative thermal analyzers (QTA) and differential thermal analyzers (DTA)	9	(X)	92,230	(X)	86,854

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1989 AND 1988--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1989		1988	
			Quantity	Value	Quantity	Value
	Analytical and scientific instruments (except optical)--Continued					
38260 38	Nuclear magnetic resonance spectrometers, including electron paramagnetic spin types (EP)	3				
38260 39	Microscopes, scanning type, including electron and proton	5	753	154,956	r856	r148,477
38260 53	Particle beam excitation instruments, including electron microprobes, augers, energy ion spectroscopes, secondary ion mass spectrometers (SIMS), ion microprobes	3				
38260 55	Photon excitation analyzers, including x-ray fluorescence - simultaneous, x-ray fluorescence - sequential, x-ray fluorescence - sequential with diffraction, x-ray fluorescence - diffraction; x-ray diffraction; and energy dispersive systems (EDS)	10	1,618	77,238	r1,640	r76,400
38260 61	Mass spectroscopy instrumentation	10	(X)	205,916	(X)	r190,691
	Clinical laboratory instrumentation (includes instruments used in the clinical laboratory for measuring, analyzing, and processing clinical specimens)	(NA)	(X)	836,293	(X)	671,200
38260 71	Chemistry (measure and identify substances, e.g. metabolites, enzymes, and drugs)	12	16,022	416,020	10,586	288,672
38260 72	Hematology (measure and identify substances or cells contained in blood or substances influencing the development and clotting of blood, e.g., cell counting coagulation factors)	7	13,582	231,284	r11,760	r209,070
38260 73	Microbiology (enumerate or identify pathogenic organisms or measure their susceptibility to anti-microbial agents)	4	727	2,417	r1,689	r7,394
38260 74	Histology (process tissue and cells, e.g., tissue processors, cell stainers)	2				
38260 75	Blood bank and immunology (process blood and specimens for testing; measure and identify, using immunoassay, substances in clinical specimens)	9	a12,585	73,811	a r13,188	b r73,761
38260 76	Other clinical laboratory instrumentation not specified above	12	(X)	112,761	(X)	r92,103
38260 78	Organic elemental analysis instruments, including carbon, hydrogen, nitrogen, oxygen, and sulphur	12	a31,255	78,870	a r29,671	r67,155
38260 92	Amino acid, protein and/or peptide analyzers (including chromatographic type)	4	392	9,756		
38260 94	Other analytical and scientific instruments n.e.c., including molecular weight, monochrometers (analytical type), nephelometers (except meteorological), osmometers, particle size analyzers, photo multipliers, surface area analyzers, turbidometers, and breatholyzers	83	(X)	440,715	(X)	r400,234
38260 98	Parts, components, and accessories for analytical and scientific instruments (sold separately), including photo tubes, thermal conductivity sensors, thermopiles, etc., which are not specifically provided for in product class 38272, Binoculars and astronomical instruments, or 38273, Other optical instruments and lenses	84	(X)	555,557	(X)	r515,336
38271	Sighting, tracking, and fire-control equipment, optical type	49	(X)	583,990	(X)	609,419
38271 01	Made from lenses, prisms, etc., produced in the same plant	23	(X)	229,791	(X)	r228,804
38271 02	Made from purchased lenses, prisms, etc	26	(X)	310,803	(X)	335,027
38271 99	Parts and accessories	8	(X)	23,396	(X)	45,588
38272	Binoculars and astronomical instruments	13	(X)	92,931	(X)	93,222
38272 01	Binoculars, prismatic and nonprismatic, terrestrial and celestial telescopes	9	(X)	74,318	(X)	r49,763
38272 03	Other astronomical instruments (excluding radio astronomy)	3				
38272 09	Parts and accessories (including mountings) for binoculars, optical telescopes and other astronomical equipment	7	(X)	18,613	(X)	13,459
38273	Other optical instruments and lenses	137	(X)	1,176,335	(X)	1,206,618
38273 12	Optical test and inspection equipment including standard sources, modulators, optical comparators, interferometers (except optical microscopes)	27	(X)	126,122	(X)	r124,235
38273 15	Optical microscopes	8	(X)	59,634	(X)	55,048
	Optical components:					
38273 17	Filters, including parts and accessories thereof	30	(X)	53,603	(X)	54,910
	Lenses, except ophthalmic focus lenses:					
38273 21	Unmounted lenses	40	(X)	98,313	(X)	96,907
	Mounted lenses:					
38273 22	Photographic lenses	8	(X)	17,748	(X)	19,780
38273 23	Other mounted lenses	17	(X)	94,063	(X)	84,317
38273 29	Other (prisms, mirrors, etc.)	43	(X)	113,191	(X)	101,461
38273 59	Other optical instruments (including optical alignment and display instruments) excluding analytical instruments and binoculars and astronomical instruments listed above and sighting and fire control equipment	37	(X)	443,990	(X)	497,905
38273 39	Parts and accessories for other optical microscopes	4	(X)	12,503	(X)	12,699
38273 49	Parts and accessories for other optical instruments	16	(X)	157,168	(X)	159,356

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1989 AND 1988—Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1989		1988	
			Quantity	Value	Quantity	Value
38291	Aircraft engine instruments, except flight	43	(X)	509,475	(X)	504,453
38291 45	Temperature sensors, transmitters, and displays	21	(X)	101,790	(X)	107,637
38291 46	Pressure ratio sensors, displays, and controls	5	(X)	17,233	(X)	r14,808
38291 47	Pressure and vacuum sensors, transmitters, and displays	14	(X)	31,029	(X)	r29,766
38291 58	Fuel and oil flow rate sensors, transmitters, and displays, including mixture controls	7	(X)	(D)	(X)	(D)
38291 60	Fuel and oil quantity sensors, transmitters, and displays including densitometers	14	(X)	113,029	(X)	98,806
38291 62	Tachometer generators and indicators	12	(X)	33,779	(X)	28,446
38291 98	All other not specified above	15	(X)	A208,837	(X)	A222,279
38291 99	Parts and components for aircraft engine instruments, except flight (sold separately)	6	(X)	a3,778	(X)	a2,711
38292	Physical properties testing and inspection equipment and kinematic testing and measuring equipment	142	(X)	961,044	(X)	893,944
	Physical properties testing equipment including hardness, tensile, stress, strain, abrasion, strength, torsion, wear, and similar testing equipment (including components and parts sold separately):					
38292 32	For testing of metals	24	(X)	196,937	(X)	189,276
38292 34	Other	45	(X)	223,580	(X)	207,567
38292 39	Parts for physical properties testing equipment (sold separately)	17	(X)	16,111	(X)	a22,428
	Physical properties inspection equipment, including flaw detection, thickness measuring, and similar inspection equipment (including components and parts sold separately):					
38292 52	For testing of metals	22	(X)	128,184	(X)	117,996
38292 54	Measuring and checking flow of fluids	13	(X)	a36,445	(X)	r32,130
38292 56	Other	37	(X)	149,297	(X)	151,445
38292 58	Parts for physical properties inspection equipment (sold separately)	17	(X)	21,589	(X)	24,226
	Kinematic testing and measuring equipment, vibration, acceleration, and other motion testing equipment):					
38292 94	For testing of metals	2	(X)	167,766	(X)	144,550
38292 95	Other	28				
38292 98	Parts for kinematic testing and measuring equipment (sold separately)	5	(X)	1,155	(X)	a r4,326
38294	Nuclear radiation detection and monitoring instruments	56	(X)	674,423	(X)	654,294
38294 02	Radiation detecting elements (including ion chambers)	14	259,870	69,013	232,586	66,893
38294 04	Solid state detectors	8	14,370	35,193	9,337	21,702
38294 06	Nuclear monitoring instruments (including environmental, personal dosimetry, and medical monitors, both stationary and portable types)	17	(X)	a137,019	(X)	a111,742
38294 07	Medical and biological counting systems for In Vivo counting	2				
38294 09	Sample and flow counting systems, manual and automatic	9	(X)	28,752	(X)	35,135
38294 19	Scalers	4	1,160	3,343	8,395	8,871
38294 21	Special amplifiers for nuclear applications	5	6,610	4,349		
	Pulse analyzers (including nuclear spectrometers):					
38294 22	Single channel pulse height analyzers	6	a1,998	b25,377	a2,218	b28,943
38294 23	Multichannel pulse height analyzers	5				
38294 25	Count rate meters	7	4,324	3,096	3,560	2,755
38294 29	Measurement and control devices using beta, gamma, or neutron gauge technology	12	(X)	199,330	(X)	186,069
38294 28	Input-output accessories for multichannel analyzers	2	(X)	b13,729	(X)	b13,140
38294 30	Nuclear power supplies	7				
38294 32	Neutron and photon activation analysis systems	2	(X)	30,878	(X)	27,617
38294 34	Nuclear instrument modules n.e.c.	9				
38294 39	Other nuclear radiation detection and monitoring instruments	12	(X)	87,408	(X)	r113,131
38294 98	Parts and components for nuclear radiation detection and monitoring instruments (sold separately)	9	(X)	37,936	(X)	38,296
38295	Commercial, geophysical, meteorological, and general purpose instruments	152	(X)	1,040,957	(X)	1,072,448
38295 20	Barometers and barographs, aneroid and mercurial types, including recorders, wall, pendant, meteorological, hygro-thermographs, barometer-thermometer-humidity combinations	14	(X)	b11,650	(X)	r10,600
38295 21	Hydrometers, glass, all types, including thermo-hydrometers	9	b300,525	b2,776	a313,162	a2,720
	Liquid-in-glass thermometers:					
38295 22	Engraved (etched) stem, thermoregulators, deep-sea reversing, laboratory, encased glass, ASTM standards, pocket case, max-min registering, except clinical thermometers	17	(X)	a9,774	(X)	r9,205
38295 23	Threaded and flanged types, fixed and adjustable angle, in-line and duct installations, for process, food, air conditioning, and refrigeration installations	11	501,491	8,635	r495,274	r8,518
38295 24	Household and commercial thermometers such as wall, outdoor, domestic science, cupcase, filled systems, indoor-outdoor	12	5,013,437	11,730	r5,063,874	r11,561

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1989 AND 1988--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1989		1988	
			Quantity	Value	Quantity	Value
38295	Commercial, geophysical, meteorological, and general purpose instruments--Continued					
38295 34	Clinical (fever) thermometers (including digital)	2	(D)	(D)	(D)	(D)
	Bimetal thermometers:					
38295 25	Threaded and flanged types, for pipeline and duct installations, including general and pocket test	18	[b]1,388,912	[a]23,567	[a] [r]1,400,679	[a] [r]22,253
38295 26	Domestic science, commercial general test, indoor, outdoor, desk models, oven, refrigerator	13	5,430,566	12,600	[r]5,392,049	[r]11,355
38295 28	Humidity indicating and recording instruments such as bi-hygroscopic and hygroscopic element, indicators, psychrometers, wet and dry bulb, hygrographs, indicating hygrometers	10	(X)	7,314	(X)	7,199
38295 29	Other thermometers (infrared, meteorological, commercial and industrial)	10	(X)	16,979	(X)	[r]13,891
38295 51	Meterological electronics equipment and radio astronomy equipment (automatic weather stations and weather tracking equipment, ceilometers, transitometers, space satellite meteorological systems, and specialized meteorological telemetering equipment)[5]	16	(X)	260,215	(X)	361,552
38295 31	Other meteorological instruments, including speed and direction instruments, rain gauges, thermographs, and parts (sold separately)	16	(X)	28,406	(X)	34,821
38295 32	Geophysical instruments, including hydrographic and hydrological	12	(X)	(D)	(X)	(D)
38295 59	Geophysical electronics equipment (exploration and other specialized geophysical equipment)[5]	25	(X)	199,890	(X)	181,622
38295 33	Other commercial and industrial instruments (except aircraft) including compasses, altimeters, test equipment for hydraulic and pneumatic systems and controls, and environmental gas detectors (sold separately)	50	(X)	268,124	(X)	[r]231,015
38295 39	Parts and accessories for meteorological and commercial and industrial instruments	10	(X)	3,778	(X)	3,635
38296	Surveying and drafting instruments and associated equipment	44	(X)	270,210	(X)	269,501
38296 11	Surveying instruments, including alidades, transits, plumb bobs, sextants, theodolites, surveyors, compasses, surveyors levels, tapes, etc	17	(X)	151,287	(X)	130,603
38296 19	Parts and components for surveying instruments (sold separately)	6	(X)	4,947	(X)	[r]4,035
38296 21	Drafting instruments and machines, manual and automatic, drafting tables, plotting instruments, slide rules, T-squares, drafting templates, rules, etc	18	(X)	104,851	(X)	124,973
38296 29	Parts and components for drafting instruments and machines (sold separately)	2				
38296 31	Photogrammetric and geodetic equipment, excluding cameras.	3	(X)	9,125	(X)	[b]9,890
38296 39	Parts and components for photogrammetric and geodetic equipment (sold separately)	2				

Note: Data for two or more product codes may be combined to avoid disclosing figures for individual companies.

The percent of estimation of each item is indicated as follows (see "Description of Survey" in the text for a discussion of estimation of missing reports): [a]10 to 25 percent of this item has been estimated. [b]26 to 50 percent of this item has been estimated. [c]Over 50 percent of this item has been estimated.

- Represents zero. (D) Data withheld to avoid disclosing figures for individual companies. (NA) Not available. N.e.c. Not elsewhere classified. [r]Revised by 5 percent or more from previously published figures. (X) Not applicable.

[1]Prior to 1989, data for product class 38122 were published in the Current Industrial Report MA36P, Communication Equipment, Including Telephone, Telegraph and Other Electronic Systems and Equipment.

[2]Product code 38122 61 includes data formerly collected under product code 38121 03.

[3]Data for product code 38210 42, "Microtomes," are included with "All other laboratory and scientific apparatus" (product code 38210 98) to avoid disclosing figures for individual companies.

[4]Data for product code 38291 58, "Fuel and oil flow rate sensors, transmitters, and displays" are included with "All other aircraft instruments" (product code 38291 98) to avoid disclosing figures for individual companies.

[5]Prior to 1989, data for product codes 38295 51 and 38295 59 were published in the Current Industrial Report MA36P, Communication Equipment, Including Telephone, Telegraph, and Other Electronic Systems and Equipment.

Table 3. COMPARISON OF VALUES OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS, AS REPORTED IN THE MA38B, THE 1988 ANNUAL SURVEY OF MANUFACTURES, AND THE 1987 CENSUS OF MANUFACTURES

(Value in millions of dollars)

Product code	Product description	1988			1987	
			Annual Survey of Manufactures			
		MA38B	Value	Standard error of estimates[1]	MA38B	Census of Manufactures
3812	Search, detection, navigation, guidance, aeronautical and nautical systems, instruments, and equipment	(X)	35,003.5	1	(X)	34,016.9
38121	Aeronautical, nautical, and navigational instruments	2,365.2	2,617.0	5	2,269.7	2,267.6
38122	Search, detection, navigation, and guidance systems and equipment[3]	31,144.9	31,574.8	1	(NA)	30,886.3
38120 00	Search, detection, navigation, guidance, aeronautical, and nautical systems, instruments, and equipment, n.s.k., typically for establishments with 10 employees or more					715.2
38120 02	Search, detection, navigation, guidance, aeronautical, and nautical systems, instruments, and equipment, n.s.k., typically for establishments with less than 10 employees	(2)	811.8	4	(2)	147.8
3821	Laboratory apparatus and furniture	(X)	1,690.9	7	(X)	1,618.8
38210 10	Laboratory apparatus				1,549.1	1,303.0
38210 20	Laboratory furniture and parts sold separately					268.6
38210 00	Laboratory apparatus and furniture n.s.k., typically for establishments with 10 employees or more	1,564.9	1,690.9	7		15.3
38210 02	Laboratory apparatus and furniture n.s.k., typically for establishments with less than 10 employees				(2)	31.9
3822	Controls for monitoring residential and commercial environments and appliance regulating controls	(X)	2,254.8	2	(X)	2,024.6
38220 00	Controls for monitoring residential and commercial environments and appliance regulating controls, typically for establishments with 20 employees or more					1,957.4
38220 02	Controls for monitoring residential and commercial environments and appliance regulating controls n.s.k., typically for establishments with less than 20 employees	2,207.2	2,254.8	2	2,092.7	67.2
3823	Process control instruments	(X)	4,748.6	2	(X)	4,371.5
38230 00	Process control instruments n.s.k., typically for establishments with 20 employees or more					4,185.2
38230 02	Process control instruments n.s.k., typically for establishments with less than 20 employees	4,347.9	4,748.6	2	4,083.6	186.4
3824	Fluid meters and counting devices	(X)	1,637.3	2	(X)	1,133.1
38242	Integrating and totalizing meters for gas and liquids	609.6	671.6	2	589.3	609.0
38243	Counting devices (excluding motor vehicle instruments)	192.5	211.2	14	197.8	219.3
38244	Motor vehicle instruments	681.6	686.0	1	232.1	241.2
38240 00	Fluid meters and counting devices n.s.k., typically for establishments with 20 employees or more					31.7
38240 02	Fluid meters and counting devices n.s.k., typically for establishments with less than 20 employees	(2)	68.5	8	(2)	31.9
3825	Instruments to measure electricity	(X)	7,682.7	1	(X)	7,612.3
38251	Integrating instruments, electrical	387.6	407.9	1	400.5	399.8
38252	Test equipment for testing electrical, radio and communication circuits, and motors	6,248.0	6,170.0	2	6,143.6	6,116.8
38253	Instruments to measure electricity	663.2	631.1	5	646.5	671.0
38250 00	Instruments to measure electricity n.s.k., typically for establishments with 10 employees or more					163.1
38250 02	Instruments to measure electricity n.s.k., typically for establishments with less than 10 employees	(2)	473.7	2	(2)	281.6
3826	Analytical and scientific instruments, except optical	(X)	3,372.6	4	(X)	3,156.6
38260 00	Analytical and scientific instruments n.s.k., typically for establishments with 5 employees or more					3,050.0
38260 02	Analytical and scientific instruments n.s.k., typically for establishments with less than 5 employees	3,442.2	3,372.6	4	3,046.1	106.6
3827	Optical instruments and lenses	(X)	2,095.1	2	(X)	1,990.2
38271	Sighting, tracking, and fire-control equipment, optical type	609.4	664.7	2	726.1	729.4
38272	Binoculars and astronomical instruments	63.2	57.1	2	35.1	36.3
38273	Other optical instruments and lenses	1,206.6	1,324.6	2	1,179.7	1,169.6
38270 00	Optical instruments and lenses n.s.k., typically for establishments with 10 employees or more					-
38270 02	Optical instruments and lenses n.s.k., typically for establishments with less than 10 employees	(2)	48.7	1	(2)	54.8

See footnotes at end of table.

Table 3. COMPARISON OF VALUES OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS, AS REPORTED IN THE MA38B, THE 1988 ANNUAL SURVEY OF MANUFACTURES, AND THE 1987 CENSUS OF MANUFACTURES--CONTINUED

(Value in millions of dollars)

Product code	Product description	1988			1987	
			Annual Survey of Manufactures			
		MA38B	Value	Standard error of estimates[1]	MA38B	Census of Manufactures
3829	Measuring and controlling devices n.e.c.	(X)	3,601.3	2	(X)	3,389.3
38291	Aircraft engine instruments, except flight	504.5	539.1	3	520.0	510.1
38292	Physical properties and kinematic testing equipment	893.9	913.4	3	859.4	906.4
38294	Nuclear radiation detection and monitoring instruments	654.3	609.8	2	637.2	645.0
38295	Commercial, geophysical, meteorological, and general purpose instruments	1,072.4	976.2	3	[3]872.6	891.5
38296	Surveying and drafting instruments and associated equipment	269.5	321.2	18	246.5	230.2
38290 00	Measuring and controlling devices n.e.c., n.s.k., typically for establishments with 10 employees or more	(2)	241.6	3	(2)	64.6
38290 02	Measuring and controlling devices n.e.c., n.s.k., typically for establishments with less than 10 employees					141.6
34918	Automatic valves, regulating and control type	1,261.9	1,126.0	6	1,221.0	1,179.9
34919	Solenoid valves (except nuclear)	338.3	317.6	2	326.9	317.3

Note: In the 1987 Census of Manufactures, shipments data for establishments of small companies (typically those with fewer than 5 employees for industry 3826; fewer than 10 employees for industries 3812, 3821, 3825, 3827 and 3829; and fewer than 20 employees for industries 3822, 3823, 3824 and 3491) were estimated from administrative records data rather than collected on census questionnaires. These shipments are included in product codes 38120 02, 38210 02, 38220 02, 38230 02, 38240 02, 38250 02, 38260 02, 38270 02, 38290 02, and 34910 02. Products not adequately identified by detail product were coded to the appropriate industry (four digits) followed by "000."

(NA) Not available. N.e.c. Not elsewhere classified. N.s.k. Not specified by kind. (X) Not applicable.

[1]The annual survey of manufactures percentage standard errors shown are the approximate relative errors of the estimates of level. A more detailed description of the standard error of estimate is given in the introduction of the annual survey of manufactures, Value of Product Shipments, M86(AS)-2, under "Qualifications of the Data."

[2]Detailed data available only for the Census of Manufactures. A substantial portion of these data are derived from administrative records. See note above.

[3]1987 value of shipments data for product class 38295 has been adjusted to include product codes 38295 51 and 38295 59 which were previously collected in the Current Industrial Report MA36P, Communication Equipment, Including Telephone, Telegraph and Other Electronic Systems and Equipment.

Table 4. SELECTED INSTRUMENTS AND RELATED PRODUCTS--SHIPMENTS, EXPORTS, IMPORTS, AND APPARENT CONSUMPTION: 1989

(Value in thousands of dollars)

Product code[1]	Product description	Manufacturers' shipments (value f.o.b. plant)	Exports of domestic merchandise: Value at port[1,2]	Exports of domestic merchandise: Estimated producers' shipments[3]	Percent exports to manufacturers' shipments	Imports for consumption value in foreign country[1,4]	Apparent consumption (value)[5]	Percent imports to apparent consumption
34918 —	Automatic valves (regulating and control type)...	1,363,169	131,267	110,881	8	273,719	1,526,007	18
34919 —	Solenoid valves, except nuclear and fluid power transfer.....	349,228	18,094	15,284	4	141,390	475,334	30
38121 —	Aeronautical, nautical, and navigational instruments, except aircraft engine instruments.....	2,532,275	[6]1,168,460	[6]922,499	3	[6]420,193	32,552,306	1
38122 —	Search and detection, navigation and guidance systems and equipment.....	30,522,337						
38210 —	Laboratory apparatus and laboratory furniture....	1,694,886	35,443	32,154	2	55,500	1,718,232	3
38220 —	Controls for monitoring residential and commercial environments and appliance regulating controls.....	2,230,089	143,669	130,337	6	151,464	2,251,216	7
38230 —	Process control instruments.....	4,802,982	244,292	221,622	5	138,187	4,719,547	3
38242 —	Integrating meters, nonelectrical type.....	641,519	35,204	31,937	5	5,985	615,567	1
38243 —	Counting devices.....	206,347	[7]49,345	[7]44,766	[7]3	[7]138,819	[7]1,449,439	[7]10
38244 —	Motor vehicle instruments.....	639,564						
38251 —	Integrating instruments, electrical.....	383,828	32,169	29,184	3	6,366	989,095	1
38253 —	Instruments to measure electricity.....	628,085						
38252 —	Test equipment for testing electrical, radio and communication circuits, and motors.....	6,163,135	644,993	585,138	10	239,187	5,817,184	4
38260 —	Analytical and scientific instruments (except optical).....	3,758,663	[6]1,128,456	[6]1,023,735	27	[6]462,486	3,197,414	15
38271 —	Sighting, tracking, and fire-control equipment, optical type.....	563,990	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
38272 —	Binoculars and astronical instruments.....	92,931	46,336	42,036	45	157,521	208,416	76
38273 —	Other optical instruments and lenses.....	1,176,335	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
38291 —	Aircraft engine instruments, except flight.....	509,475	([7])	([7])	([7])	([7])	([7])	([7])
38292 —	Physical properties and kinematic testing and inspection equipment.....	941,044	422,251	383,066	41	62,552	620,530	10
38294 —	Nuclear radiation detection and monitoring instruments.....	674,423	184,792	167,643	25	31,151	537,931	6
38295 —	Commercial, geophysical, meteorological, and general purpose instruments.....	1,040,957	24,065	21,832	2	51,931	1,071,056	5
38296 —	Surveying and drafting instruments and associated equipment.....	270,210	268,540	243,619	90	128,399	154,990	83

(NA) Not available.

[1] For comparison of SIC-based product codes, Schedule B export numbers, and HTSUSA import numbers, see table 5.

[2] Source: Bureau of the Census report, EM 522, U.S. Exports.

[3] These values were derived by use of adjustment factors to exclude freight, insurance, and other charges incurred in moving goods to the port of export. This adjustment is made to convert the values to an approximation of the producers' value of exported goods. Current adjustment factors are based on data for 1986 which are published in Exports from Manufacturing Establishments, AR86-1, appendix B. The adjustment factor for products corresponding to industry group 349, miscellaneous-fabricated metal products, is 0.8447. The adjustment factor for products corresponding to industry group 381, engineering, scientific instruments, is 0.7895. The adjustment factor for products corresponding to industry group 382, measuring and controlling devices, is 0.9072.

[4] Source: Bureau of the Census report, IM 145, U.S. Imports for Consumption.

[5] Apparent consumption is derived by subtracting exports from the total of manufacturers' shipments plus imports.

[6] Data include products which are extraneous to this product class. Therefore, the values may be overstated.

[7] Import and export data for procuct class 38291 have been included with procuct classes 38243 and 38244.

Table 5. COMPARISON OF STANDARD INDUSTRIAL CLASSIFICATION-BASED PRODUCT CODES WITH SCHEDULE B EXPORT NUMBERS, AND HTSUSA IMPORT NUMBERS: 1989

Product code	Product description	Export number[1]	Import number[2]
34918 00	Automatic valves, regulating and control type (except nuclear)	8481.80.9015 8481.80.9020 8481.80.9030 8481.80.9035 8481.80.9045 8481.80.9050	8481.80.9015 8481.80.9020 8481.80.9030 8481.80.9035 8481.80.9045 8481.80.9050
34919 00	Solenoid-operated valves, except nuclear and fluid power transfer	8481.80.9005	8481.80.9005
38121 00 38122 00	Search, detection, aeronautical, nautical, and navigational and guidance systems, equipment, and instruments, except aircraft engine instruments	8526.10.0010 8526.10.0020 8526.10.0070 8526.91.0010 8526.91.0030 8526.91.0070 8526.92.0000 9014.10.1040 9014.10.1080 9014.10.6040 9014.10.6080 9014.10.7040 9014.10.7080 9014.10.9040 9014.10.9080 9014.20.2000 9014.20.6000 9014.20.8040 9014.20.8080 9014.80.2000 9014.80.6000	8526.10.0020 8526.10.0040 8526.91.0020 8526.91.0040 8526.92.0000 9014.10.1000 9014.10.6000 9014.10.7000 9014.10.7030 9014.10.7060 9014.10.9000 9014.20.2000 9014.20.6000 9014.20.8040 9014.20.8080 9014.80.1000 9014.80.2000 9014.80.4000 9014.80.5000
38210 00	Laboratory apparatus, except scientific instruments	8417.80.0000 9016.00.0000	8417.80.0000 9016.00.2000 9016.00.6000
38220 00	Controls for monitoring residential and commercial environments and appliance regulating controls	9032.10.0000 9032.20.0000 9032.89.6020	9032.10.0000 9032.10.0030 9032.10.0060 9032.10.0090 9032.20.0000 9032.89.6015 9032.89.6020 9032.89.6025
38230 00	Process control instruments	9032.81.0040 9032.81.0080 9032.89.6030 9032.89.6040 9032.89.6050 9032.89.6060 9032.89.6070 9032.89.6075	9032.81.0020 9032.81.0060 9032.81.0080 9032.89.6030 9032.89.6040 9032.89.6050 9032.89.6060 9032.89.6070 9032.89.6075
38242 00	Integrating and totalizing meters for gas and liquids	9028.10.0000 9028.20.0000	9028.10.0000 9028.20.0000
38243 00 38244 00 38291 00	Motor vehicle and aircraft engine instruments (except flight) and counting devices	9029.10.0000 9029.20.4040 9029.20.5000 9029.90.0000 9106.20.0000	9029.10.4000 9029.10.8000 9029.20.4040 9029.20.4080 9029.90.2000 9029.90.8040 9029.90.8080 9106.20.0000
38251 00 38253 00	Electrical integrating and electricity measuring instruments	9028.30.0000 9028.90.0040	9028.30.0000 9028.90.0040

See footnotes at end of table.

Table 3. COMPARISON OF STANDARD INDUSTRIAL CLASSIFICATION-BASED PRODUCT CODES WITH SCHEDULE B EXPORT NUMBERS, AND HTSUSA IMPORT NUMBERS: 1989--Continued

Product code	Product description	Export number[1]	Import number[2]
38252 00	Electrical, radio, and communication circuits and motors testing equipment	9029.20.6000 9030.31.0000 9030.39.0040 9030.39.0080	9029.20.6000 9030.31.0000 9030.39.0040 9030.39.0080
38260 00	Analytical and scientific instruments, except optical	9012.10.0000 9027.20.2000 9027.20.4040 9027.20.5000 9027.20.9000 9027.30.4040 9027.30.4080 9027.50.1000 9027.50.5000 9027.80.2000 9027.80.3000 9027.80.3500 9027.80.8000 9027.90.0000	9012.10.0000 9027.20.4040 9027.20.4050 9027.20.4060 9027.20.4080 9027.20.8030 9027.20.8060 9027.20.8090 9027.30.4040 9027.30.4080 9027.50.4010 9027.50.4015 9027.80.4020 9027.80.4030 9027.80.4060 9027.80.4090 9027.80.8020 9027.80.8030 9027.80.8060 9027.80.8090 9027.90.4000 9027.90.8000
38272 00	Binoculars and astronomical instruments	9005.10.0020 9005.10.0040 9005.10.0080 9005.80.4020 9005.80.4040 9005.80.6000 9005.90.0000	9005.10.0020 9005.10.0040 9005.10.0080 9005.80.4020 9005.80.4040 9005.80.6000 9005.90.0000
38292 00	Physical properties testing and inspection equipment and kinematic testing and measuring equipment	9024.10.0000 9024.80.0000 9024.90.0000	9024.10.0000 9024.80.0000 9024.90.0040 9024.90.0080
38294 00	Nuclear radiation, detection, and monitoring instruments	9030.10.0000 9030.90.4000	9030.10.0000 9030.90.4000
38295 00	Commercial, geophysical, meteorological, and general purpose instruments	9025.11.2000 9025.11.4000 9025.19.0000 9025.20.0000	9025.11.2000 9025.11.4000 9025.19.0000 9025.20.4000 9025.20.8000
38296 00	Surveying and drafting instruments and associated equipment	9015.10.0000 9015.20.0000 9015.30.0000 9015.40.0000 9015.90.0000 9017.10.0000 9017.20.4000 9017.20.8000	9015.10.4000 9015.10.8000 9015.20.4000 9015.20.8000 9015.30.4000 9015.30.8000 9015.40.4000 9015.40.8000 9015.90.0010 9015.90.0020 9015.90.0030 9015.90.0040 9017.10.0000 9017.20.4000 9017.20.8040 9017.20.8080

[1]Source: 1989 edition, Harmonized System-Based Schedule B, Statistical Classification of Domestic and Foreign Commodities Exported from the United States.
[2]Source: Harmonized Tariff Schedule of the United States, Annotated (1989).

DESCRIPTION OF SURVEY

Scope of Survey. This survey covers firms engaged in the manufacture of instruments and related products, except very small firms (generally less than 20 employees) for which 1987 Census of Manufactures data were derived from administrative records of other government agencies.

Survey Methodology. The statistics in this publication were collected by mail on Bureau of the Census annual Form MA38B, Selected Instruments and Related Products. The survey panel includes all known producers of these products, except the very small firms excluded from the scope of the survey. Approximately 1,850 companies are included. No estimate is derived for the small firms excluded from the survey.

Reliability of Data. Survey error may result from several sources: (1) inability to obtain information about all cases in the survey; (2) response errors; (3) definitional difficulties; (4) differences in the interpretation of questions; (5) mistakes in recording or coding the data obtained; and (6) other errors of collection, response, coverage, and estimation for missing data. These nonsampling errors also occur in complete censuses. Although no direct measurement of the biases due to nonsampling errors has been obtained, precautionary steps were taken in all phases of the collection, processing, and tabulation of the data in an effort to minimize their influence.

A major source of bias in the published estimates is due to imputing data for nonrespondents, for late reporters, and for data which fail logic edits. Missing figures are imputed based on yearly movements shown by reporting firms. Imputation generally is limited to a maximum of 10 percent for any one data cell. Figures with imputation rates greater than 10 percent are footnoted.

The imputation rate is not an explicit indicator of the potential error in published figures due to nonresponse, because the actual yearly movements for nonrespondents may or may not closely agree with the imputed movements. The range of difference between the actual and imputed figures is not precisely known, but is assumed to be small. The degree of uncertainty regarding the accuracy of the published data, however, increases as the percentage of imputation increases. Figures with imputation rates above 10 percent should be used with caution.

Revisions to Previous Period Data. Statistics for previous years may be revised as the result of corrected data from respondents, late reports for which imputations were made as described above, or other corrections. Figures which have been revised by more than 5 percent from previously published figures are indicated by footnotes.

Revisions include changes to prior period data resulting from reconciliation of the results of this survey with the 1988 Annual Survey of Manufactures to correct differences in reported data between the two series and to identify and verify new establishments included in the scope of this survey. Table 3 presents a comparison of data from the two series by census product class following the reconciliation.

Adjustment for Price Change. All dollar figures included in this publication are in current dollars; i.e., they have not been adjusted for price change.

EXPLANATION OF TERMS

Quantity and Value of Shipments. The figures on quantity and value of shipments represent physical shipments of all products sold, transferred to other establishments of the same company, or shipped on consignment, whether for domestic or export sale. The value represents the net sales price, f.o.b. plant, to the customer or branch to which the products are shipped, net of discounts, allowances, freight charges, and returns. Shipments to a company's own branches are assigned the same value as comparable sales to unaffiliated customers; i.e., the value includes an appropriate allocation of company overhead and profit. Products bought and resold without further manufacture are excluded.

Electronic Systems—Unified Architecture. Includes system-type control, display and computing instruments actuated from standardized electrical transmission signals in which control and signal conditioning are integral with the display/operator interface.

Electronic Systems—Non-Unified Architecture. Includes system-type instruments and related equipment actuated from standardized electrical transmission signals in which control and signal conditioning are separated from the display/operator interface. Equipment includes single loop and multi-loop controllers, dedicated operator stations, shared CRT-based operator work stations, process I/O equipment, communication equipment and other related miscellaneous equipment such as power supplies, racks, panels, cables, console furniture, printers, tape drives, mounting hardware, shelves, nests, calibrators, testors, etc. Does not include multi-function process computers reported in 3823012.

Industrial Multi-Function Process Computers. Includes the hardware and standard software of the CPU and all peripheral equipment of the computers that provide centralized processing intelligence for two or more of the following functions: data manipulation and reporting, supervisory control and data acquisition, calculations using control algorithms, data base management, use of a high-level programming language and operator interface.

COMPARISON OF EXPORT, IMPORT, AND DOMESTIC OUTPUT DATA

The trade comparisons shown in this report should be considered only as approximations. Several problems prevent precise comparisons among imports, exports, and domestic output. These problems include the following:

- Export and import comparisons do not account for the origin of materials used to manufacture the finished product. Domestic output includes any goods that undergo substantial transformation into a finished product in the U.S., even if the goods are partially constructed abroad or are constructed of imported materials.
- There will be a lag between the time a producer makes or ships a product and the time it is actually exported. Similarly, there may be a lag between the time a product is imported and when it enters into U.S. distribution channels.
- The basic structure of these classification systems differ. The Standard Industrial Classification (SIC) system used for domestic output was developed independently of the Harmonized System (HS) used to classify imports and exports. The level of detail provided by the different systems varies substantially, reflecting their different objectives. For example, there are a number of imported commodities that have no comparable domestic output classification.
- Because producers' shipments of some commodities may be used as materials for incorporation into other commodities, combinations of domestic output data for such commodities may contain some duplication.
- Import and export data reflect the movement of merchandise into and out of U.S. foreign trade zones, the U.S. Virgin Islands, and the U.S. customs territory of the 50 States, the District of Columbia, and Puerto Rico. Domestic output reflects activity in the 50 States and, only if specified, in Puerto Rico.
- Import and export data generally do not distinguish between new, used or rebuilt commodities.
- The valuation of the three data sets differ. Domestic output is valued at the point of production. It includes the net sales price, f.o.b. plant, after discounts and allowances, and excludes freight charges and excise taxes. Exports are valued at the point of exportation. It includes the net sales price or value, and inland freight, insurance and other charges to the export point. Imports are valued at the first port of entry in the United States. They include the cost, insurance, freight, duty, and other charges to the import point.
- Detailed commodity information is not included for individual export or import shipments at or below a certain dollar limit. This dollar limit is $1,500 for exports and $1,000 for imports, except for import of textiles and textile products, gloves, footwear, and miscellaneous rubber and plastics products, where the limit is $250.

HISTORICAL NOTE

Data on selected instruments and related products have been collected by the Bureau of the Census since 1961. Historical data may be obtained from Current Industrial Reports available at your local Federal Depository Library. A list of these libraries may be obtained from the Bureau of the Census regional offices:

Office	Telephone
Atlanta, Georgia	(404) 347-2271
Boston, Massachusetts	(617) 565-7100
Charlotte, North Carolina	(704) 371-6142
Chicago, Illinois	(312) 353-6251
Dallas, Texas	(214) 767-0621
Denver, Colorado	(303) 286-2200
Detroit, Michigan	(313) 226-7742
Kansas City, Kansas	(913) 236-3728
Los Angeles, California	(213) 209-6616
New York, New York	(212) 264-3860
Philadelphia, Pennsylvania	(215) 597-4920
Seattle, Washington	(206) 442-7800

Historical data are also available on microfiche. For further information contact the Bureau of the Census, Data User Services Division, (301) 763-4100.

RELATED REPORTS

The Bureau of the Census publishes the following related reports:

Series	Frequency	Title
Current Industrial Reports		
MA36A	Annually	*Switchgear, Switchboard Apparatus, Relays, and Industrial Controls*
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Series	Frequency	Title
Other Industrial Reports		
M3-1	Monthly	*Manufacturers' Shipments, Inventories, and Orders*
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(MC)	Quinquennially	Census of Manufactures
Foreign Trade Reports		
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IM 145 FT 246	Monthly Annually	*U.S. Imports for Consumption—HTSUSA—Commodity by Country*

CONTACTS FOR USERS

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Manufacturers' Shipments, Inventories, and Orders	Ruth Runyan	(301) 763-2520
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To order a Current Industrial Report	Superintendent of Documents (GPO)	(202) 783-3238
To subscribe to a Census Bureau publication	Superintendent of Documents (GPO)	(202) 275-3054

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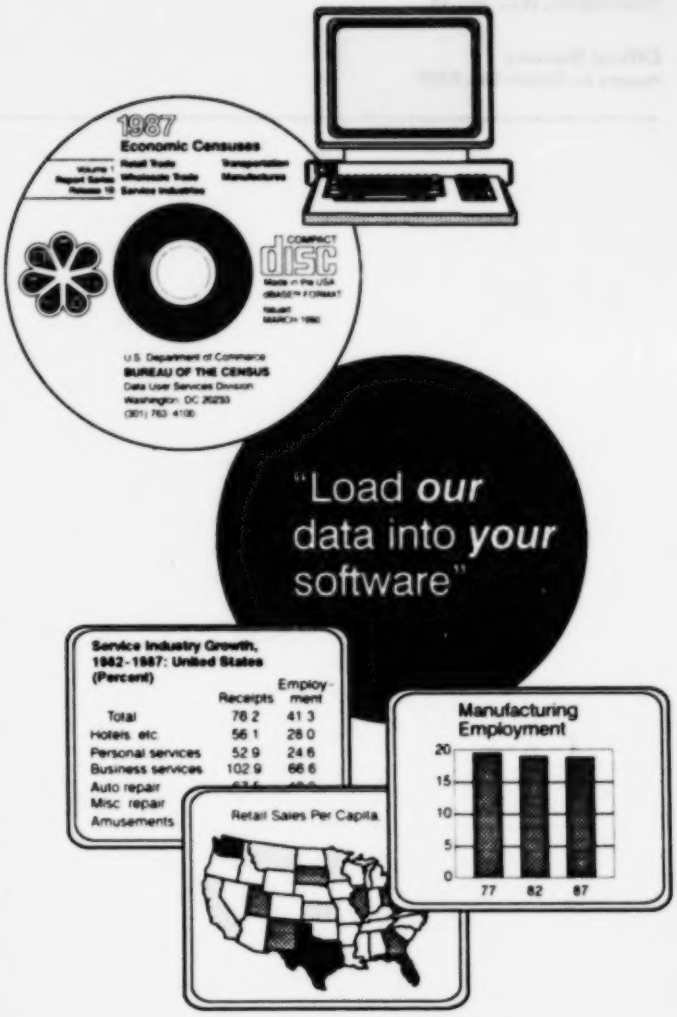

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